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# Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Lubrication of Power Farming Machinery

Lubrication of Steam Traction Engines

PUBLISHED MONTHLY BY
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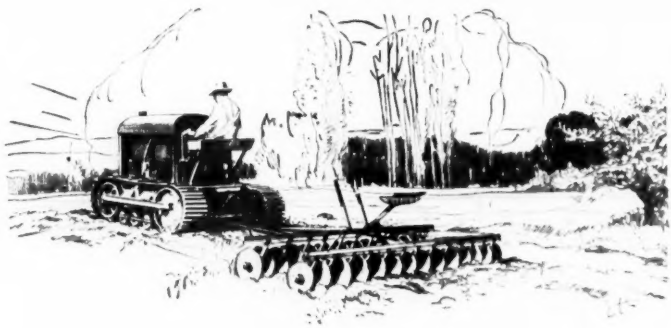

# The business of farming

IN 1880 one farmer labored to provide food and raw materials for his family and half of another family.

Today one farmer provides food for himself and TWO other families.

Thus the increase of population and the trend of population toward industrial centers, with a consequent labor shortage, has operated to change the hap-hazard occupation of the farmer into a huge mechanical project.

The contrast between "grandfather's time" and today can be shown by the following:

When grandfather wished to confer high praise on a farm hand, he said he was a "good mechanic." By this he meant that the man was clever at splicing harness, repairing fences, rigging up stump pullers and other forms of manual labor.

Today a good mechanic, on a modern farm, must have an intimate knowledge of machinery which would not be amiss in a machine shop or power plant.

* * * * * * *

This issue of "Lubrication" deals with the mechanical side of "the business of farming." It should be interesting to the "city man," as it shows something of the scope of this enormous mechanical field—and the farmer will find in it some practical aids toward achieving better lubrication.

[ *Texaco Lubricants for agricultural machinery are widely sold all over the country, and that where they cannot be procured from a local dealer, they can be secured instantly from our more than* **800** *stations.* ]

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# LUBRICATION

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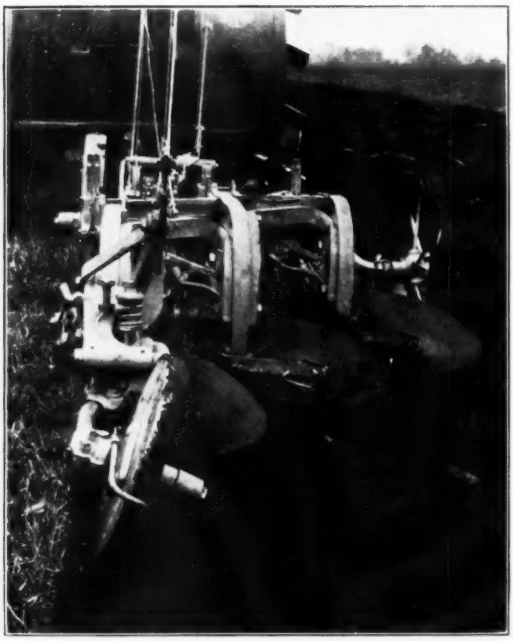
# Lubrication of Power Farming Machinery

THE development of the tractor and the adaptation of mechanical power to the operation of farming implements have brought about a remarkable change in agricultural methods of recent years. Today the horse is relatively dwarfed by the economy and extensive power capacity of the modern tractor. This is no disparagement of the horse; it is merely the culmination of the efforts of engineering talent to place the farmer on a productive par with other producers. As a result it may be said that as in every other industry, the development of farming machinery has kept pace with our national progress. Minutes today are as the hours of yesterday to the modern power farmer, and a 20 hour working day in the height of the season is not unusual. The tractor, of course, is the controlling element in such operations, although specific equipment such as the gang plough, disc harrow, cultivator, harvester and threshing machine all must be given due consideration. In reality, man has to a large extent ceased to be the laborer, as elsewhere in the industrial world, performing instead the role of operator or supervisor to a machine that performs his former duties far more effectively than he ever could.

As a result of this extensive transition to machinery, the responsibilities placed upon the operators have increased to a marked extent. No longer does the farmer send a hired hand to town every so often with a gallon can to get "some axle oil," and he has ceased to smear the lubricant on the wearing parts with a piece of kindling wood. Instead, today in all probability he relies on the advice of an experienced lubricating engineer from a reputable oil company, and according to the construction requirements of his machines, selects his lubricants for each specific purpose with the same care as he would select his seed. For as seed is worthless without proper planting, cultivation and harvesting, just so are these latter operations relatively ineffective today unless efficiently performed by machinery that is so faultlessly lubricated that it will, if necessary, stand up 20 out of every 24 hours throughout the season.

Generally speaking, modern grain farming can be regarded as comprising a number of definite operations such as:

1. TILLING
   - *a.* Ploughing
   - *b.* Discing
   - *c.* Harrowing
   - *d.* Packing
2. SEEDING
   - *a.* Drilling
   - *b.* Sowing
   - *c.* Packing



*Courtesy of International Harvester Company of America*

Fig. 1.—Details of a modern gang plow showing manner of locating the shares, and the proximity of certain of the bearings to the earth.

3. Cultivating
   - *a.* Weed killing by cultivators
   - *b.* Discing
   - *c.* Shovel Plowing

4. Harvesting
   - *a.* Heading
   - *b.* Cutting and bundling
   - *c.* Picking and husking (corn)
   - *d.* Mowing and raking (hay)

5. Threshing
   - *a.* Separating grain from roughage
   - *b.* Cleaning
   - *c.* Delivering

6. Hauling

The advantages of performing relatively all of the above operations by machinery are not confined to labor and time saving, however. In addition, we must consider the thoroughness and timeliness of each job. For example, in ploughing and seeding, the productivity of the soil will depend upon the depth of the cut, the uniformity of pulverization of the seed bed, and the retention of the proper amount of moisture. In the sowing of any grain there is a certain right time when the seed should be put into the ground in order to obtain the maximum yield per acre. Therefore in order to achieve this timeliness it is not only essential that sufficient power equipment of adequate size be available but as well they should be absolutely dependable in operation. The importance of proper lubrication in this regard can not be over-estimated. Again, in threshing, there is the very important matter of grain loss in the chaff, which can practically only be overcome by means of the modern power driven thresher with its arrangement of oscillating racks, cleaning sieves, and wind stacking device.

Power farming consists of the application of steam or internal combustion engine power to mechanical farming equipment. In the case of tilling, cultivating and harvesting machinery, etc., the motive equipment is usually located ahead and pulls the machines through a drawbar attachment. Other equipment such as the thresher, corn husker and shredder, and ensilage cutter, are generally operated in stationary position, being driven by belt connection from the tractor. Power farming equipment can therefore broadly be classified

*Courtesy of International Harvester Company of America*

Fig. 2.—The operating mechanism of a plow showing parts that require lubrication, and the customary method of oiling by hand.

*Courtesy of International Harvester Company of America*

Fig. 3.—A disc harrow in action. Lubrication on such a machine is confined to relatively few shaft bearings, and an oil-can is usually adequate for the purpose.

as draw-bar and stationary, according to its drive and general operation.

### Draw-bar Equipment

Farming machinery which is usually grouped under this classification will include:

Gang ploughs
Disc and tooth harrows
Cultivators
Planters, drills and seeders
Manure spreaders
Grain binders
Grain headers
Reapers
Harvester-thresher rigs
Hay mowers and rakes
Hay loaders and stackers
Hay tedders (tossing devices)
Corn pickers and binders, etc.

The manner in which any of these machines may be arranged for operation will depend upon the acreage of the farm and the tractor equipment available. From the handling of a light draft 2-share plow attached directly to the tractor, to the pulling of a series of perhaps a dozen disc harrows, is but a question of the nature of the ground and the power of the tractor.

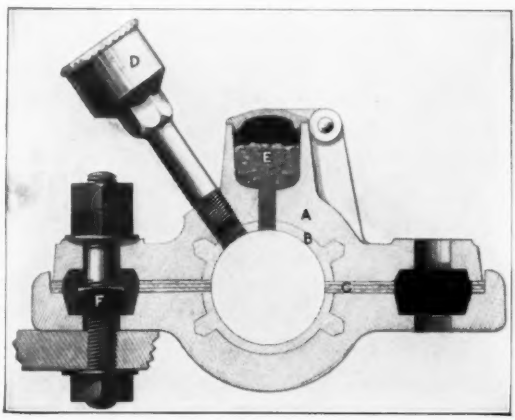
The functions of the equipment tabulated above are practically explained by their names, and merely involve the performance of time-honored farming operations in a new way, by means of mechanical devices. As a general rule, mobile farm equipment will, therefore, involve a more or less complex arrangement of gearing, and chain driven mechanisms according to the class of work to be done. For example, perhaps the simplest device is the gang plow or disc harrow, where we will merely have an arrangement of plow shares rigidly fixed in parallel order upon the body of the tractor or plow beam; or a number of steel harrowing discs, attached in upright and parallel position to a common draw beam or spindle. Naturally on such machines there is little lubrication necessary, if we except the tractor (which will be discussed in a later issue of LUBRICATION) and we will simply have to deal with axle bearings and a relatively small number of adjustment gears and smaller bearings.

On the other hand, machinery such as corn pickers and binders, etc., are far more intricate in their construction and involve a relatively complicated system of chain and gear driven fixtures.

Machinery of this type is usually built with a number of roller and self-aligning bearings in order to reduce draft to a minimum.

### Lubrication of Draw-Bar Equipment

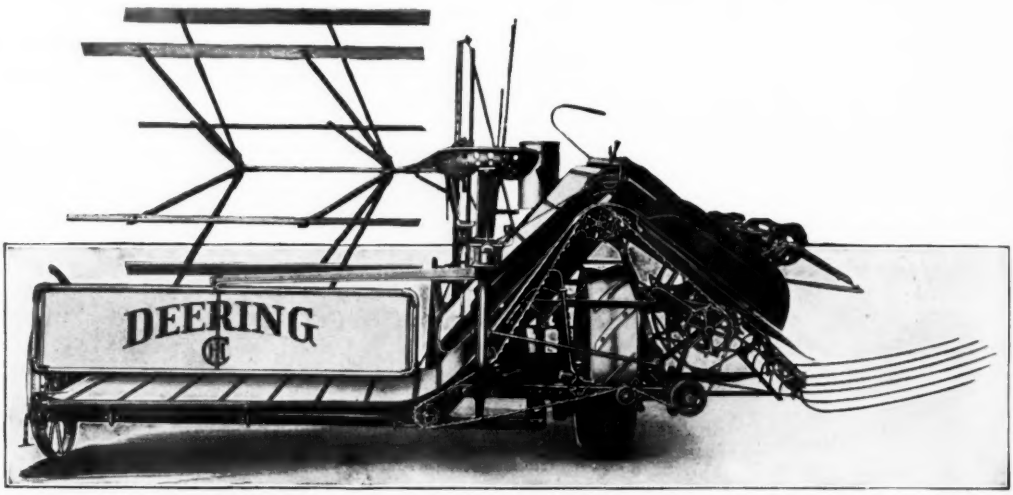
As a general rule, lubrication of such machinery as ploughs, harrows, reapers, corn pickers and binders, etc., should be carefully carried




*Courtesy of International Harvester Company of America*

Fig. 4.—Section View of one method of lubricating a Thresher Cylinder Shaft Bearing by means of both grease and oil. "D" is the grease cup and "E" the oil cup.

out, due to the usual hard service to which the wearing parts will be subjected. These machines will often be exposed to the weather for long periods, especially during the farming season when they will stand out in the fields continuously whether in service or not. As a result, the numerous widely scattered bearings, of their service and their continual operation in the presence of dirt, dust, chaff and straw, renders satisfactory lubrication a practical impossibility. As a general rule, were a suitable gear and chain lubricant applied it would not serve its intended purpose due to the fact that there would often be such an accumulation of




*Courtesy of International Harvester Company of America*

**Fig. 5.—Type of Grain Binder which is designed to cut and bind the grain in suitable bundles for threshing. Roller bearings are a feature on such machines.**

chains and gears will tend to accumulate dust and dirt, which will very soon bring about abnormal wear unless they are frequently cleaned and supplied with fresh lubricant. In addition, rain will tend to wash lighter lubricants from the bearings. As a result of these conditions, modern power farming machinery is often equipped with compression grease cups or in a few cases, sight feed oil cups. On the other hand many of such machines are still built with no provision for lubrication except oil holes. These should, of course, be cleaned out as completely as possible before each oiling or else carefully capped to prevent entry of dirt. Where oil cups are installed or hand lubrication is necessary, the lubricant used should be a high grade pure mineral engine oil, having a viscosity of from 500″ to 750″ Saybolt at 100° F. Where grease lubrication is called for, a medium bodied compression cup grease will give the most satisfactory service.

Although chains and sprockets will be subject to quite as severe wear as bearings, the nature foreign matter that excessive power would be required to operate the machine, or even the chains might be thrown from the sprockets in extreme cases. For this reason, chains are usually run dry unless each respective roller can be readily oiled through specially drilled oil holes. On smaller exposed gears which mesh directly it is usually satisfactory and more economical to use the same grade of engine oil as recommended for bearings. This will be of sufficiently low viscosity to not accumulate foreign matter to any great extent, and it may be readily applied with an oil can when other parts of the machine are lubricated.

When such gears are enclosed in a relatively tight gear case, a fairly heavy gear compound of about 1000″ Saybolt viscosity at 210° F. will be most economical.

On such parts of certain equipment as hay loader cranks, disc-harrow axles and thresher feeder cranks, etc., where duty is not too severe and adequate reservoirs are impractical or too expensive, wood bearings are oftentimes used.

Such bearings are usually oiled by hand and inasmuch as they are porous to a certain extent they tend to decrease shaft wear.

## Belt Driven Machinery

*The Threshing Machine*

Of the stationary or belt-driven machinery used on the farm, the thresher is without a doubt the most important adjunct to production, as well as being the most interesting implement to the layman. The function of the threshing machine is to remove the seed kernels from the heads of the stalks after the latter have been cut and bound by the binder. The modern thresher performs this by a beating action, somewhat similar to the historic flail, the grain being passed between a series of movable and stationary beating teeth. The stationary teeth, set in "concave," serve to momentarily hold the stalks in place, while the movable teeth, which are carried on a rapidly rotating cylinder, pass between them and strike the unthreshed heads with blows of sufficient force to open the chaff and cause the kernels or grain to loosen and separate therefrom.

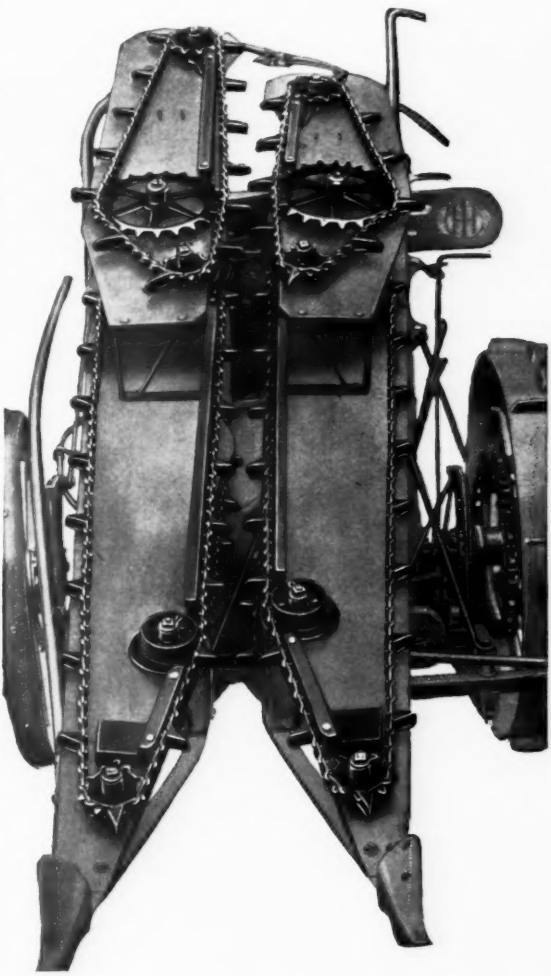
In general, the modern threshing machine embodies four distinct steps in the complete shelling, separation and cleaning of the grain, i.e.,

1. *Threshing*—wherein the revolving cylinder and stationary "concave," with their respective teeth, serve to loosen the grain. Thus the majority of the shelled kernels fall through the grates to the grain pan.

2. *Separation*—wherein the loosened or retained kernels are separated from the hulls or straw by means of a rotating beater which serves to push the straw back from the threshing members to the separator. A checkboard or apron is hung in back of the beater to stop the passage of flying grains; and a series of racks or parallel grates are arranged for rotary oscillation by means of suitable operating mechanisms. Thus the straw is tossed back through the machine by periodic motion. This action also jars and loosens the straw sufficiently to enable any remaining grain to drop between the racks to the cleaning device.

3. *Cleaning*—wherein the kernels are cleaned from dirt, dust, weed seeds and chaff by passing the entire mass over suitable vibrating sieves through which a uniform blast of air is blown.

4. *Delivering*—wherein the cleaned grain and straw are carried separately out from the machine by special carrier devices, such as the grain spout, weigher or wagon loader, the tailings elevator which returns grain and chaff which has not been completely thrashed out back to the threshing cylinder, and the wind stacker or straw handling device which carries the straw and chaff by air blast from the machine to the stack or loft.



*Courtesy of International Harvester Company of America*

Fig. 6.—Details of a modern corn picker showing the extensive arrangement of conveyor chains, etc. for carrying the stalks to the binding attachments.

*Other Belt-Driven Equipment*

Other belt driven (stationary) machinery such as the corn husker and ensilage cutter, etc., involve no individual peculiarities of especial interest. The corn husker and shredder, in fact, is designed and operates in a similar manner to the threshing machine, although naturally many of its specific features are different by virtue of the function it must perform. As its name implies, it serves to snap the ears of corn from the stalks, husk and deliver the ears much as the thresher does with other varieties of grain, and shred the stalks and leaves which, with the husks are delivered by a wind stacker to the storage loft.

The ensilage cutter is a machine devised for the purpose of cutting green but almost mature corn fodder for stock feeding purposes. Essentially it consists of a series of rotary cutting blades driven by the tractor or traction engine, and operating in conjunction with a delivery and conveying mechanism which serves to fill the silo storage bin.

The belt drive principle can readily be extended further to include portable saw mills, pumps, dairy machines, and lighting sets. Such equipment while widely used is nevertheless not exactly considered as power farming machinery.

## Lubrication of Belt-Driven Machinery

*The Threshing Machine*

In general practice, threshing machine lubrication is usually regarded as one of the most important phases of farm machinery upkeep, due to the dependence which is placed on the thresher during the threshing season. Any delay in operation traceable to improper lubrication, such as the occurrence of scored or burned out bearings, may frequently set back the entire working schedule so as to not only materially affect the net yield of the grain crop but as well the planting of the next crop, especially where winter wheat is a feature. As a result, the selection and application of suitable thresher lubricants should never be slighted as unimportant.

Threshing machines today embody a series of high speed shafts, bearings, belts, chains and pulleys. Motive power is applied to all major operating mechanisms by the simple expedient of flexible belt connections either directly or indirectly from the main driving shaft which receives its power in a similar manner from the tractor or traction engine.

The essential problem involved is to overcome the tendency of so many farmers to use cheap black oils or improperly compounded grease products in which a relatively low price is the only redeeming feature. It is very true that the thresher, like all other such equipment, operates under injurious conditions, and that bearings are constantly subject to high pressures and to dust, dirt, chaff and the likelihood of being exposed to rain, but this should only be all the more reason for selecting the highest grade lubricants in order to insure as much protection as possible. In brief, the life of a thresher and its ease and efficiency of operation, will be governed to a great extent by its lubrication.

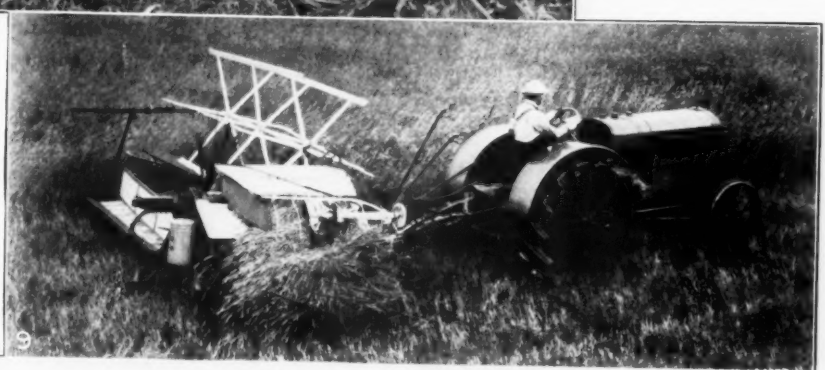
Bearing lubrication should generally receive the most consideration, whatever means are installed for this purpose. On such parts as the cylinder bearings, automatic force feed lubricators, chain oilers or wick feed systems are extensively used. Other smaller bearings, however, will often be designed for oil cup or hand lubrication, or else provision will be made for grease. There is a growing tendency to equip the shafts of stacker blowers, cylinders and fans with anti-friction bearings such as roller or ball bearings, to insure dependability, in which event a pure mineral lubricant of the nature of petrolatum should be used, or else a medium grade of liquid grease. The cylinder bearings are subject to perhaps the hardest service, and hence the preference for a positive means of lubrication that will not require too frequent attention. Hand lubrication, merely by the means of oil holes, is not to be recommended due to the tendency there will be for dust accumulation. Of course such oil holes will usually be picked free from dust by the operator prior to oiling (unless they are provided with a hinged cover), yet this method of lubrication is never as dependable as the use of some form of enclosed oil cup. For bearings

*Courtesy of International Harvester Company of America*

Fig. 7.—The Automatic Hay Loader in action.

*Courtesy of International Harvester Company of America*

Fig. 8.—Corn picking by Tractor Power.



*Courtesy of International Harvester Company of America*

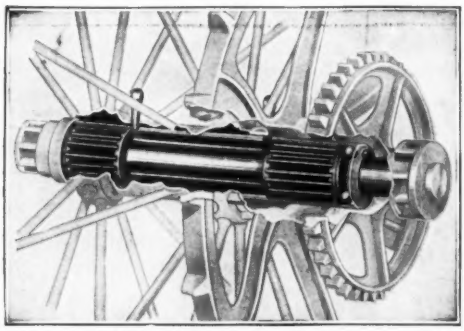
Fig. 9.—The Grain Cutter and Binder in the wheat fields.

*Courtesy of Advance-Rumely Thresher Company, Inc.*

Fig. 10.—Threshing by Tractor Power. The threshing machine on the left is belt driven by a kerosene tractor.

SOME PHASES OF HARVESTING

in general, a straight mineral engine oil having a viscosity of from 500″ to 750″ Saybolt at 100° F. will be most suitable. Where certain thresher builders prefer grease lubrication they will equip their machines accordingly with either lock cap compression grease cups or some



*Courtesy of International Harvester Company of America*

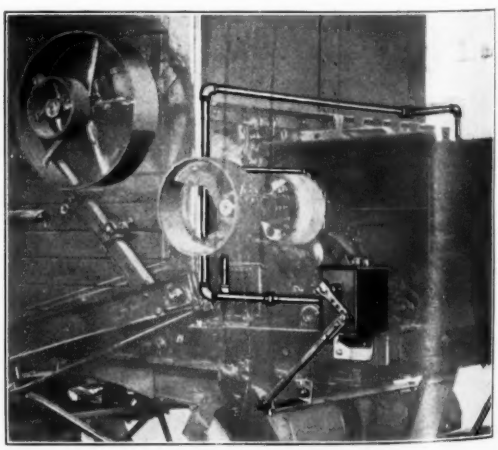
Fig. 11.—Main Wheel Roller and Thrust Ball Bearing as used on many harvesting machines today.

pressure lubricating system. Where grease is required, a light or medium grade of product, free from acid or alkali, should be used, the body depending upon weather conditions and the type of grease cups.

Cheap compounds of a relatively light mineral oil and some form of poorly refined vegetable oil are frequently offered the farmer as substitutes for the more costly mineral oils. However, the mineral constituent of such compounds will be so light as to have considerable tendency toward evaporation, especially at the shaft ends where exposed to the air, with the result that the remaining lubricant will gum and dry out, to probably cause overheated bearingsand an increase in power consumption.

There are a certain number of gears, sprockets and chains involved on the thresher, the lubrication of which is frequently a source of discussion. As a rule, it is recommended that these be run dry, as mentioned heretofore, due to the excess of dust, dirt and straw that will always be present. Such chains usually consist either of stamped steel or malleable iron links without rollers or pins. Thus the application of a gear lubricant would in all probability cause straw, dirt and dust to accumulate to such an extent as to hamper the operation of the chains, or even throw them off the sprockets. If desired, chains may be removed periodically, cleaned thoroughly in kerosene, dried, and dipped in warm lubricating oil. This is an effective means of lubrication provided the chains are drained prior to replacement on the sprockets.

In thresher operation, it is essential to maintain the revolving threshing cylinder in practically perfect balance at all times. Otherwise, considerable vibration and pounding will occur which will tend to cause flat journals, worn and overheated bearings, and increased power consumption. Such a condition can not be remedied by using a heavier grade of lubricant, although the detrimental results will be somewhat postponed. The only solution is to balance the cylinder carefully by removing it from the thresher and testing with the journals supported by horizontal knives, or straight edges. According as the cylinder rolls on its supports with the tendency of the heavier parts to turn downward, the lighter side can be weighted to bring back the balance as necessary. The usual reasons for a cylinder being out of balance are the wearing of teeth or the renewal of others irregularly without regard to the distribution of weight. On the other hand, cylinder journal boxes should not be set up too tightly, else friction, power consumption, and overheating will increase markedly, leading ultimately to burned out bearings.



*Courtesy of Madison-Kipp Corporation*

Fig. 12.—A method of lubricating the Cylinder Bearings on a Threshing Machine by means of an automatic force feed lubricator.

Overheating of stacker fan bearings and belt tightener bearings when they are of the plain babbitted type is oftentimes encountered and seemingly impossible of being overcome by increasing the rate of lubrication. In such cases, the tightness of the driving belt is usually the real key to the situation. An abnormally tight belt will most surely cause such bearings to run hot. However, this is no reason for running with a belt so loose as to cause slipping. Judgment in regulating the tightener pulley, and regular attention to lubricating equipment will prove the best insurance against overheating of such bearings.

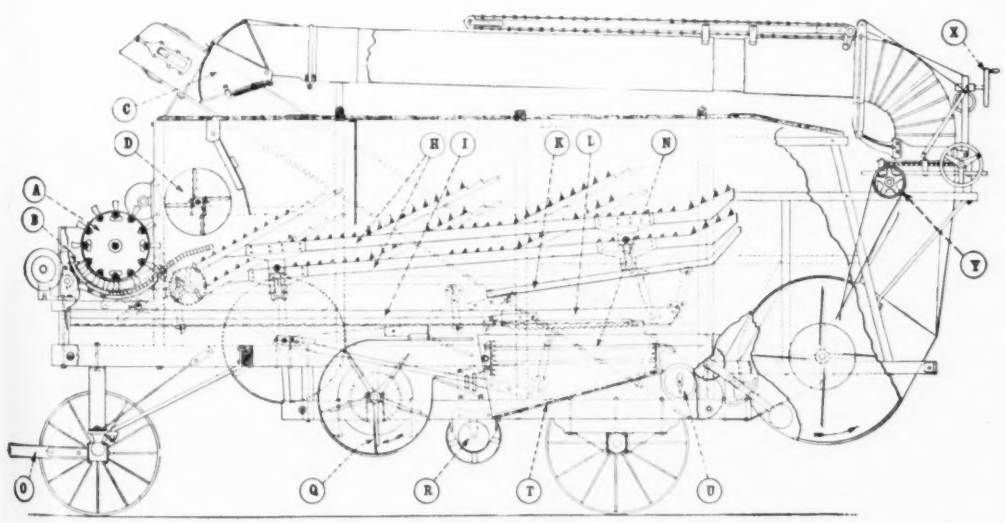
*Miscellaneous Belt-Driven Equipment*

There are essentially no lubrication features involved in the operation of any of the above machines which have not been discussed heretofore, under Thresher Lubrication or elsewhere. Operating conditions are practically the same, and mechanisms such as bearings, chain and sprocket drives, small gears, and belts, are usually all we will have to deal with.

Grease cup lubrication is preferred by the builders of such machines wherever positive lubrication is required, although oil cups are frequently met with. The disadvantage of the latter, however, is that breakage of the glass bodies is oftentimes altogether too prevalent. Hand lubrication is also still a prominent feature on many machines of this type. Again, some progressive builders have designed the more important bearings of their machines for chain oiling, or have even installed roller and ball bearings in some cases.

On all such equipment the lubricant will depend upon the nature of the oiling system. For grease cup service a medium bodied compression cup grease should be used. Where oil is required, as in sight feed oil cups, chain oilers, or for hand lubrication, a straight mineral engine oil of from 500″ to 750″ Saybolt viscosity at 100° F. will be satisfactory. Roller and ball bearings will require a semi-solid lubricant of the nature of petrolatum, or a medium grade of liquid grease.

It will generally be found most satisfactory on such machines, as on other power farming equipment, to run chains and sprockets dry. The reason for this has already been mentioned. On the other hand, it will often be possible and beneficial to remove chains frequently and clean and dip them in oil as explained above. Small gears can be lubricated as stated heretofore.




*Courtesy of the International Harvester Company of America*

Fig. 13.—Details of a Modern Threshing Machine. Grain is fed between the teeth of cylinder "A" and concave "B". Nearly all separation occurs here, the grain falling to grain pan "I". The beater "D" throws the straw received from the cylinder to straw racks "H" Suitable shaking here removes any remaining grain, dropping it to the return pan "K" and thence to the grain pan ahead of the chaffer "L". As grain and chaff are forced to the chaffer, air from fan "O" removes the chaff, and the grain falls to sieve "N". Further cleaning takes place on sieve "T". The grain finally falls to the auger "R" for discharge. A tailings auger "U" returns any unthreshed grain to the cylinder again. "C" is the adjustable hood of the wind stacker pipe, "Y" the pulley operating the oscillating device, and "X" the wheel for raising and lowering the pipe.

with the same engine oil or gear compound as used elsewhere on the farm.

### Conclusion

It has been only possible to touch briefly upon this very essential topic of power farming machinery and its lubrication, due to the varied character of the implements involved. Enough stress has been laid upon operating conditions, however, to indicate the importance of proper and sufficient lubrication. Power farming is essentially a periodic industry, and work must be done when soils, grain, and weather conditions are right. Postponement of any phase of the work will almost surely hamper production; hence all machinery must be kept in readiness for prompt and continued service when necessary. Only by careful attention to the principles of lubrication involved can this be assured.

# Lubrication of Steam Traction Engines

*Courtesy of Port Huron Engine and Thresher Company, and Madison-Kipp Corporation*

Fig. 14.—A Steam Traction Engine and Thresher rig hitched up for hauling to the job.

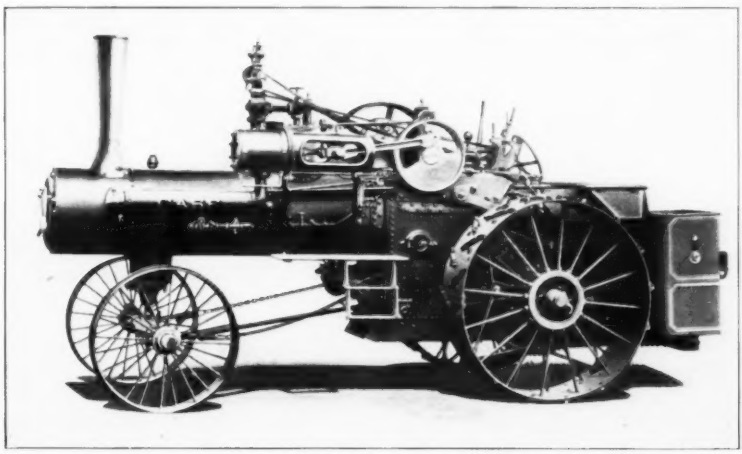
IN conjunction with power farming machinery the steam traction engine is still an important factor, notwithstanding the growing popularity of the internal combustion engine tractor which will be discussed in a forthcoming issue of LUBRICATION. By virtue of the fact that the tractor or traction engine is the heart of our modern power farming equipment, it is perfectly logical to regard its lubrication as the keynote of operating efficiency.

Steam traction engines are chiefly used today for stationary or belt drive service. Draw-bar work is, however, possible where necessary. It is frequently stated by authorities that there is more power per dollar of investment available than in a gas tractor, inasmuch as the steam traction engine has a greater momentary power reserve to draw from in event of a suddenly applied overload.

In usage the steam traction engine has preceded the gas tractor by many years. In fact, the majority of threshermen have been educated to steam. Usually fuel is not a determining factor in the choice of a tractor. In general a steam machine is bought and used because it has proven more adaptable and economical to the farmer in question. However, fuel may dictate usage in some localities, as, for example, the straw burning engines, used in the Northwest farming regions.

Steam traction engines are usually built today with a locomotive type boiler, although return tubular, or upright types may be also encountered. In general, the locomotive boiler is preferred. The engine on such a machine is installed on the top side of the boiler, and consists of an ordinary single or double cylinder reciprocating device, equipped with a plain slide or piston type valve. According to the make of the machine, the valve chest may be located on the side of the cylinder taking steam

from a standard type of steam dome, or the valve chest and steam dome may be incorporated into one, in which event, the valves are located below the cylinder, as on certain foreign machines. The traction wheels are driven through suitable trains of gearing and



*Courtesy of J. I. Case Threshing Machine Company*

Fig. 15.—Side Elevation of a Steam Traction Engine, showing location of the engine upon the boiler. The driving gears and other pertaining mechanisms which require careful lubrication are also in evidence.

reduction mechanisms from the crank-shaft of the engine.

## Lubrication

*Steam Cylinders*

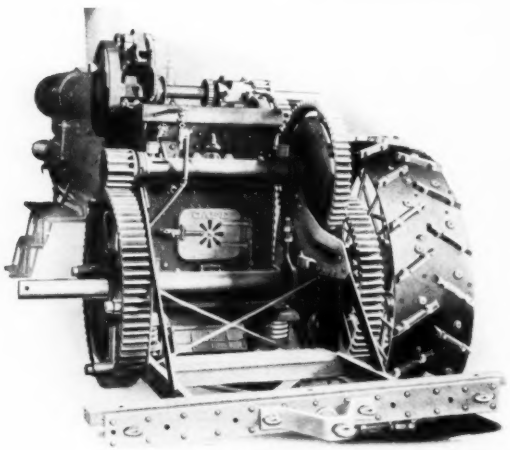
The chief problem in efficiently lubricating a steam traction engine will be to properly introduce cylinder oil into the steam chest and cylinder. The manner in which this will be carried out will depend largely upon the construction of the engine. Where the boiler is fitted with a steam dome in the center, and the valve chest is located alongside or above the cylinder, usually steam will be taken through a short steam header connection from the top of the dome. In a machine of this type, it is possible to install an automatic force-feed lubricator which will furnish cylinder oil to the steam header, several inches back from the throttle valve. Hydrostatic lubricators may also be used if desired. On such machines, with good feed water steam will usually be fairly dry under normally level operation, and there will be little or no danger of slugs of water passing over to the engine.

In many cases, however, steam traction engines will be compelled to take their feed water from all manner of sources, and there will be considerable probability of foaming and priming, due to impurities and foreign matter. The occurrence of this will cause abnormally wet and dirty steam, with the result that the film of lubricant may be prematurely washed from the cylinder walls and valve seat. Another detrimental feature often arises also when steam traction engines are operated on road service and up and down hills. Depending on the type of boiler and location of the steam dome, when so operated, they may require so much water in the boiler to cover the crown sheet, as to cause excessively wet steam. Even a half and half mixture has been experienced. Naturally such conditions will put abnormal demands on the lubricant, and generally the oil film will be washed off the walls entirely.

As a result of these detrimental elements a relatively high compound cylinder oil having a viscosity of from 130″ to 150″ Saybolt at 210° F. is recommended. It is never safe for the farmer to attempt to economize on his cylinder lubricant by selecting a poor grade, low compound oil, due to the fact that he can never be positive of the purity of his boiler feed water, or the operating conditions his engine will have to meet from day to day.

Certain types of steam tractors which are built with the steam chest incorporated with

the steam dome will involve lubrication difficulties due to the fact that the oil will tend to drip from the bearing surfaces back into the boiler. It is impossible, of course, to introduce the lubricant into the steam on such machines, and hence the principle of atomization is out of the question. It is therefore customary to in-



*Courtesy of J. I. Case Threshing Machine Company*

Fig. 16.—View of the Transmission Gearing, and rear of boiler and engine on a steam traction machine. It is readily seen that gear lubrication is an important factor on such an engine.

stall cylinder lubricators on top and at each end of the steam cylinder. These may be either force-feed or drip type devices. Thus the lubricant is depended upon to find its way over the surface of the cylinder walls with the aid of the piston, and the valve seat will probably receive a certain amount of lubrication by virtue of the oil in the exhaust steam. It can be appreciated, however, that engines of this type are never certain of receiving the proper amount of lubrication, and there will always be the tendency to regulate the lubricators for an excessively rapid flow, with the probable result of wasted oil.

*Bearings*

Due to the fact that the steam traction engine will normally operate with a threshing machine or ensilage cutter, etc., it is customary to use the same grades of lubricants throughout the rig as far as possible. Therefore, on all bearings, either a relatively heavy straight mineral oil of from 500″ to 750″ Saybolt viscosity at 100° F. will be used, or else a medium bodied compression cup grease, according to the type of lubrication equipment installed.

The governor on most engines will require especial attention and it should be regularly oiled when the machine is in continuous (daily) operation. Usually the lubricant should be applied about every three or four hours, and the oil holes should be kept free from dust accumulation. It is even advisable to wash the oil holes and bearings with kerosene in many cases. A poorly lubricated governor will develop racing and the resultant friction may cause abnormal wear to the extent that speed control will be materially hampered.

In certain cases the operators will prefer to use cylinder oil for bearing lubrication, and thus eliminate the purchasing of a special oil for this purpose. When bearing clearances are high, this may be a beneficial procedure, but under ordinary conditions it will be more economical to use the lighter viscosity engine oil which should be used in any event on the thresher rig and other belt driven machinery.

Certain of the bearings on steam traction engines will be frequently equipped with compression grease cups, and grease lubrication will be necessary. Connecting rod and crosshead bearings in particular can be efficiently lubricated with grease, for which purpose a medium bodied compression cup grease will be found most suitable, as has been stated above.

*Gearing*

Steam traction engine gearing will normally operate exposed and subject to the washing effect of rain, and the abrasive action of a certain amount of dust, chaff and dirt, etc. As a result a gear lubricant must be used which will be so adhesive as to stick to the teeth whatever the operating conditions, and resist the absorption of foreign matter as much as possible, in order not to develop into an abrasive compound. Certain grades of so-called gear greases are therefore unsuited for such service, inasmuch as their nature and body permits of the entry of dust and dirt to a large extent. Experience has proven that the lubricant for this purpose should be a straight mineral product, having a viscosity of about 1000″ Saybolt at 210° F. This lubricant is best applied to the gears in heated condition, being painted on lightly with a brush while the machine is in slow motion.



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